

direction of their Professor of Natural History, M. Shelting, made an excursion in the Ala tau Mountains. Numerous measurements of heights were made during the journey, good zoological, botanical, and geological collections, for the Museum of the College, were made, and a detailed diary of the excursion was kept by the scholars. The students of the Tashkent Normal School, as well as the pupils of the College of Verny, have also made scientific journeys for the exploration of the neighbourhood, and we learn that the College of Orenburg has requested tickets at reduced rates from the railway company for undertaking next summer a series of explorations in that little known but very interesting province. We cannot but wish that the colleges and schools of Western Europe would follow these examples; what an excellent training in natural science might thus be given, and what a mass of valuable information might be collected.

THE members of the scientific expedition which was sent out by the St. Petersburg and Moscow Societies of Naturalists for the exploration of the White Sea and of the Murmanian coast of the Arctic Ocean, and which consisted of Professors Wagner, Bogdanoff, Tsenkovsky, and eight students of the University, have returned after having done some very successful work; they bring home very rich zoological and geological collections. Professors Wagner and Tsenkovsky stayed throughout the summer at the Solovetsky Islands; M. Lavroff in Kandalaksha Bay; Prof. Bogdanoff travelled along the whole coast to Vadsö; MM. Koudravtzeff and Pleske, geologists, have travelled from Kandalaksha to Kola; others have explored the flora and the fauna of the ocean; Prof. Bogdanoff has also studied the fishing.

BARON A. VON HUGEL is now engaged in writing a work upon Fiji, where he travelled and spent some time, making extremely extensive and complete anthropological collections. The work will be more particularly an ethnological one, and most of the weapons, fabrics, and other ethnographic articles are being figured to accompany the text. The crania collected by Baron von Hugel have already been acquired by the Royal College of Surgeons, and exhaustively described by Prof. Flower.

WE notice the appearance of an important work published by the Russian Geographical and Economical Societies in the first volume of a "Collection of Materials for the Knowledge of the Russian Commune." It contains detailed descriptions of the communes of the Governments Ryazan, by M. Semenov, president of the Russian Geographical Society, MM. Litochenko, Zlatovratsky, Mme. Yakouchkin, &c.; a very complete bibliographical index of the literature concerning the communes of Russia and of Western Europe.

A TELEGRAM has been received at St. Petersburg from Col. Prejevalsky, dated from Urga, the 1st inst., stating that during the spring and summer of this year he surveyed a part of the basin of the Upper Hoang-ho and the Lake Koko Nor. He also passed through Alashan, in the centre of the Gobi desert, to Urga. Col. Prejevalsky states that during the expedition he traversed a distance of 7200 versts, and that he has succeeded in obtaining valuable scientific results.

THE death is announced, on his passage home from West Africa, of Count de Semellé, who has been recently exploring on the Lower Niger.

THE new *Bulletin* of the Société Khédiviale de Géographie contains a paper by General Purdy-Pacha on the country between Dara and Henfiah El Nabass, together with a map of that portion of Darfur, and another on Medina twenty years ago, by Col. Mohamed Sadik-Bey, illustrated by two engravings.

THE Church Missionary Society have received news that the Rev. P. O'Flaherty, their new agent in Uganda, and Mr. C. Stokes, with the Waganda chiefs and a large caravan, started from Saadaui for the interior on August 9, but in little more than three weeks Mr. O'Flaherty was taken ill at Kidete, and will be unable to proceed to the Victoria Nyanza at present.

THE same Society have also received letters from various members of the Nyanza mission, giving a much more favourable report of their position in Uganda than had reached England some time back. Rev. G. Litchfield had in consequence of ill-health made an attempt to push northwards to Lado, in order to consult Dr. Emin Effendi. In this he unfortunately failed, being stopped by Kabba Rega, the king of Unporo, who has

seized M'ruli and other posts vacated by the Egyptians since Col. Gordon's departure. Mr. Litchfield accordingly returned to Rubaga, and, crossing the lake, proceeded to Upui, hoping eventually to get to Upwapwa, where Dr. Baxter is stationed.

MESSRS. CAMERON AND PIGOTT, of the China Inland Mission, have made a journey of eight months through a great part of Manchuria and a portion of Mongolia. From the treaty port of Newchwang Mr. Pigott went on to Moukden, while Mr. Cameron proceeded along the coast in an easterly direction by the borders of Corea, and then northwards to Moukden. They next journeyed through part of Mongolia into Kirin, which at first they found fertile and well-wooded, but afterwards the country became wild, poor, and sparsely populated. The city of Kirin was reached by a long steep descent through fine scenery. Fine teams of oxen were here met with, comparing favourably with some of our best breeds. After spending a few days at Kirin the two missionaries returned overland to Peking, passing the Great Wall at Shan-hai-kwan or Ling-yü-hsien.

MESSRS. RILEY AND CLARKE, of the same Society's station at Chungking, have recently paid a visit to some Lolo villages in Southern Szechuen. These mountaineers for the most part live in inaccessible fastnesses beyond the reach of the Chinese authorities, and are not confined to Szechuen and Yunnan, but under the designations of Laos and sundry other names are found throughout the extensive regions of Annam, Siam, and Burmah. Hardly anything is yet known of the Chinese Lolos and their manners and customs, but before long the agents of the China Inland Mission in the south-west will, it may be hoped, find means to collect information regarding them.

ON A DISTURBING INFINITY IN LORD RAYLEIGH'S SOLUTION FOR WAVES IN A PLANE VORTEX STRATUM¹

LORD RAYLEIGH'S solution involves a formula equivalent

$$\text{to } \frac{d^2 v}{dy^2} - \left(m^2 + \frac{\frac{d^2 T}{dy^2}}{T - \frac{n}{m}} \right) v = 0.$$

Where v denotes the maximum value of the y -component of velocity;

" m " a constant such that $\frac{2\pi}{m}$ is the wave-length;

" T " the translational velocity of the vortex-stratum when undisturbed, which is in the x -direction, and is a function of y ;

" " " the vibrational speed, or a constant such that $\frac{2\pi}{n}$ is the period.

Now a vortex stratum is stable, if on one side it is bounded by a fixed plane, and if the vorticity (or value of $\frac{dT}{dy}$) diminishes as we travel (ideally) from this plane, except in places (if any) where it is constant.

To fulfil this condition, suppose a fixed bounding plane to contain ox and be perpendicular to oy ; and let $\frac{dT}{dy}$ have its greatest value when $y = 0$, and decrease continuously, or by one or more abrupt changes, from this value, to zero at $y = a$ and for all greater values of y .

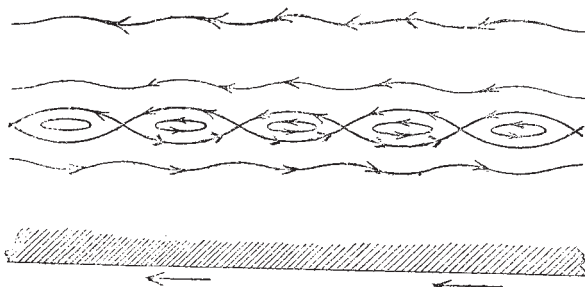
It is easily proved that the wave-velocity, whatever be the wave-length, is intermediate between the greatest and least values of T . Hence for a certain value of y between 0 and a , the translational velocity is equal to the wave-velocity, or $T = \frac{n}{m}$. Hence for this value of y the second term within the bracket in Lord Rayleigh's formula is infinite unless, for the same value of y , $\frac{d^2 T}{dy^2}$ vanishes.

We evade entirely the consideration of this infinity if we take only the case of a layer of constant vorticity ($\frac{dT}{dy} = \text{constant}$ from $y = 0$ to $y = a$), as for this case the formula is simply

$$\frac{d^2 v}{dy^2} = m^2 v,$$

¹ By Sir William Thomson. British Association, Swansea, Section A.

but the interpretation of the infinity which occurs in the more comprehensive formula suggests an examination of the stream-lines by which its interpretation becomes obvious, and which proves that even in the case of constant vorticity the motion has a startlingly peculiar character at the place where the translational velocity is equal to the wave velocity. This peculiarity is represented by the annexed diagram, which is most easily understood



if we imagine the translational velocities at $y = 0$ and $y = a$ to be in opposite directions, and of such magnitude that the wave velocity is zero; so that we have the case of standing waves. For this case the stream-lines are as represented in the annexed diagram, in which the region of translational velocity greater than wave-propagational velocity is separated from the region of translational velocity less than wave-propagational velocity by a cat's-eye border pattern of elliptic whirls.

MINERAL RESOURCES OF NEWFOUNDLAND

ORES of copper have been found in all the older formations in Newfoundland, from the Laurentian gneiss at the base, to the Carboniferous series at the summit, the qualities of which vary greatly with the age and condition of the rocks with which they are associated. Thus in the Laurentian series the rich ores of variegated and sometimes grey sulphide of copper are more frequent than any other, and are for the most part in white quartz veins intersecting the strata; but while these ores have in many cases been found on analysis to yield at the rate of from 50 to 70 per cent. of metal, the quantities available at any one place hitherto tested have never yet been found sufficient to warrant an outlay of capital.

In the succeeding series, which I conceive to be the equivalent of the *Huronian* of Canada, and have provisionally called *intermediate*, as being intermediately situated between rocks of the Laurentian and Primordial Silurian ages, very rich ores of copper are likewise well known at many parts, chiefly in white quartz veins, and also in faults and dislocations, particularly near the junction with the fossiliferous Primordial, in which cases the indications may sometimes be regarded as favourable for the probable future development of mines. Several attempts have already been made in this direction at various parts of the distribution of the series, but except at a few places, chiefly near the junction with the newer formations, with but slender prospect of a successful issue.

By reference to the Custom House returns of exports I find that the amount and value of copper ore shipped at St. John's between the years 1854 and 1864 inclusive was as follows:—Ore, 627½ tons, value \$22,980 = 4,596*l.* sterling. The places where this ore was raised are not specified, but I believe it was all derived from rocks of intermediate age, by which the greater part of the Peninsula of Avalon is occupied.

In addition to the above export from St. John's, 544 tons, valued at \$19,179 were exported between the years 1875 and 1879; but a considerable, if not the larger portion of this ore was produced from Tilt Cove and other of the early openings in Notre Dame Bay.

Although the presence of copper is frequently indicated by stains of green carbonate and small nests of yellow sulphuret in the lower Primordial strata, I am not aware of any instances where the ores occur in mass, or in intersecting veins or lodes, except it may be close to their immediate junction with the older series on which they repose unconformably or butt up against in faults. At some parts of their distribution, such as in the

islands of Conception Bay, these older Silurian rocks are but very little disturbed, resting in nearly a horizontal attitude, and scarcely at all altered; at other parts, such as Trinity Bay, St. Mary's Bay, Langlois Island of the Miquelons and elsewhere, they are greatly disturbed by intrusions of igneous rock, and occasionally to some extent metamorphosed; but they are almost everywhere crowded with organic remains, the types of which indicate the ages they represent, to extend from the horizon of Primordial or Cambrian to the newer Potsdam Group of the United States and Canada. Strata representative of Potsdam, Calcareous, and Levis ages, containing abundance of typical fossils, are extensively displayed on the western and northern parts of the island, the former in many cases resting directly on Laurentian gneiss unconformably; but, except it may be to a very limited extent in Canada Bay, near the Cloud Mountains, I am not aware of any deposits older than the Potsdam at these parts, nor have I seen indications of the presence of the Huronian or intermediate system north of Bonavista Bay, or anywhere near the western shores. Galena in calcareous veins is of frequent occurrence in these Lower Silurian rocks, but except in small isolated crystals or patches the ores of copper are particularly rare, and in no case such as to be considered economically valuable.

But the cupriferous formations proper of Newfoundland, according to my view of the structure, lie unconformably above all the former, and consist mainly of a set of metamorphic and igneous rocks, corresponding exactly in mineral character and condition with the rocks of the Eastern Townships of Canada described by Sir Wm. Logan under the title of the Quebec Group. I am quite aware that these views, as regards the structure, are at variance with those entertained by several distinguished geologists in Canada (whose opinions, however, do not seem to be very unanimous on the subject); and there cannot be a doubt that in many cases the evidences appear to be so contradictory at different localities that the difficulties in arriving at the truth are exceedingly great. Nevertheless, so far as my own observations go, and I have studied the succession at nearly all parts of their distribution in Newfoundland, I am led to the conclusion that the stratigraphical position of this metamorphic group belongs to a horizon intermediate between the Calcareous and Hudson River group, probably chiefly of Chazy age, which is in accord with the structure of Sir W. E. Logan.

The group consists of chloritic, dioritic, and felsite slates, interstratified with compact diorites, bands of red jasper, dolomites, great masses of serpentine, or serpentinous rock, and volcanic products. In nearly all these rocks the ores of copper are more or less disseminated; but it is amongst the schistose portions, especially the chlorite slates, that they seem to be most abundant, and it is in rocks of that quality chiefly where the principal mining operations have hitherto been conducted. At some parts of the distribution these rocks are distinctly stratified, the lines of deposit being well displayed in layers of different quality: beds of jasper, conglomerate, &c. The whole series is magnesian, more or less, but particularly towards the top, which appears to be the horizon of the serpentinous masses, with large accumulations of volcanic ash. Towards the base the rocks become calcareous, the cliffs of strata much incrustated with carbonate of lime; and some strata of a pure white crystalline limestone occur which are fossiliferous. The fossils are too obscure to be identified with certainty; but one form bears a strong resemblance to a *Maclurea*, another to a *Bellerophon*, a third to a *Murchisonia*, and some rather large-sized *Encrinure* stems. Near the horizon of this limestone moreover we find a set of black slates which contain graptolites. Vast intrusive masses of granitoid rock, and great dykes of greenstone melaphyre and other traps intersect the formation.

The only mines of importance in active operation up to the present time are all situated in Notre Dame Bay, and these are Union Mine Tilt Cove, Betts Cove Mine, Colchester, in southwest arm of Green Bay, Little Bay Mine, Rabbit's Arm, and Seal Bay. Many openings and minor workings have also been made at various parts of the bay, at each of which the ores of copper were more or less indicated, some of which may eventually, when capital and skilled labour are brought to bear, be found sufficiently remunerative to be worked to advantage.

It will be seen by the annexed memoranda that the total value of the copper and nickel ore extracted since 1854, but by far the larger proportion since 1864, when the Union Mine Tilt Cove was first opened by Mr. Smith McKay, amounts to nearly one million sterling.